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paper,¹⁹ dealing especially with the behavior of the pollen tube in connection with double fertilization in *Carpinus Betula*. As the previous paper pointed out, this form is chalazogamic, and usually has several embryo sacs, which develop caeca that penetrate deeply into the chalazal region. The course of the pollen tube varies considerably, but usually it enters the embryo sac at the base of the caecum. Premature arrival of a pollen tube results in more or less branching and coiling about the sacs; and belated pollen tubes also occur, long after fertilization has been accomplished. The polar fusion nucleus is in the caecum, and as the pollen tube passes it one of the male cells (probably the one farthest from the tip) is discharged through a small spur-branch, the other one being discharged upon the arrival of the tip in proximity to the egg. Sometimes the spur-branch, containing a male cell, develops sufficiently to discharge it for the fertilization of the egg of an adjacent embryo sac, in this case triple fusion not occurring. The paper also presents a somewhat elaborate comparison of *Carpinus* and *Casuarina*, as the basis of a suggestion that the latter genus should be regarded as a subfamily of Betulaceae.—J. M. C.

Dust spray vs. liquid.—CRANDALL²⁰ reports the results of a very thorough study of the comparative merits of the dust spray and the ordinary liquid Bordeaux mixture against the scab and sooty blotch of apple and the codling moth and curculio of apple. The dust spray cost about 52 per cent less than the liquid spray and there was further gain in the reduced weight of material to be transported about in the orchard. On the contrary there seemed to be no difference in the thoroughness of application under similar conditions, and the workmen were unanimous in considering the liquid spray the least disagreeable one to apply. And then as to the final and most important test, that of efficiency, CRANDALL says, in conclusion, "The results of the experiments are sufficiently decisive to warrant the conclusion that dust spray is absolutely ineffective as a preventive of injury from prevailing orchard fungi, and that it is considerably less efficient as an insect remedy than is the liquid method of applying arsenites."—E. MEAD WILCOX.

Nature of starch.—In a recent article, FISCHER²¹ scouts the idea suggested by CZAPEK²² that starch may be a mixture of colloidal and crystalline materials, saying that so far as he knows there is not the slightest evidence for such a belief.

¹⁹ BENSON, MARGARET, SANDAY, ELIZABETH, and BERRIDGE, EMILY, Contributions to the embryology of the Amentiferae. Part II. *Carpinus Betula*. Trans. Linn. Soc. London Bot. II. 7:37-44. *pl.* 6. 1906.

²⁰ CRANDALL, C. S., Spraying apples. Relative merits of liquid and dust applications. Bull. Ill. Exp. Stat. 106:205-242. *pl.* 1-9. *figs.* 1-5. 1906.

²¹ FISCHER, HUGO, Ueber die colloidale Natur des Stärkekörner und ihr Verhalten gegen Farbstoffe. Beihefte Bot. Cent. 181:409-432. 1905.

²² CZAPEK, F., Biochemie der Pflanzen 1. Jena 1904.

He does not refer to the work of KRAEMER²³ or of MAQUENNE and ROUX,²⁴ who independently and from very different standpoints have found evidence of such a mixture. Since starch shows seven characteristic colloidal properties and only two crystalline properties he concludes that it is a colloid.

The author discusses at length the theories of staining with anilin colors, dismisses as wrong the adsorption theory, and concludes that, while in some cases, as in the staining of proteids, the reaction may be largely chemical, in most cases the taking up of the color is by solution, dyes not soluble in water being soluble in starch. He further concludes that the solution is a liquid and not a solid solution, the colloidal starch in the swollen grains being in a liquid state.—EDNA D. DAY.

Heterospory in *Sphenophyllum*.—This genus has been regarded as strictly homosporous, but THODAY²⁵ now describes and figures a section through the strobilus of *S. Dawsoni* which shows two adjacent sporangia, one of them containing spores of uniform size, the other containing fewer and larger spores, among which are seen numerous very small aborted ones. These contrasting sporangia certainly suggest heterospory, but the largest of the supposed megaspores has only about 1.5 times the diameter of the spores of the other sporangium. It will be remembered that in *Calamostachys Casheana* the megaspores are only three times as large as the microspores, and this was felt to be a remarkably small difference.—J. M. C.

Proteid metabolism in the ripening barley grain.—The first section of a paper to consist of three has been presented by SCHJERNING.²⁶ A short notice to call the attention of physiologists is appropriate here, but the reliability of the methods and conclusions must remain unconsidered. The author finds that species, variety, or type *per se* do not affect the chemical composition of the dry matter of the grain so far as the nitrogenous and mineral constituents are concerned. As the grain develops to maturity there is a constant tendency toward equilibrium between the nitrogenous constituents, which is established at maturity and which is not disturbed during subsequent storage except in the case of certain albumins.—RAYMOND H. POND.

²³ KRAEMER, HENRY, The structure of the starch grain. BOT. GAZETTE. 34: 341. 1902.

²⁴ MAQUENNE et ROUX, Sur la constitution, la saccharification et la rétrogradation des empois de fécule. Comptes Rendus Acad. Sci. Paris 140: 1303-1308. 1905.

²⁵ THODAY, D., On a suggestion of heterospory in *Sphenophyllum Dawsoni*. New Phytol. 5: 91-93. figs. 14. 1906.

²⁶ SCHJERNING, H., On the protein substances of barley, in the grain itself and during the brewing processes: First section: On the formation and transformation of protein substances during the growth, ripening, and storage of barley. Compt.-Rend. Lab. Carlsberg 6: 229-305. 1906.